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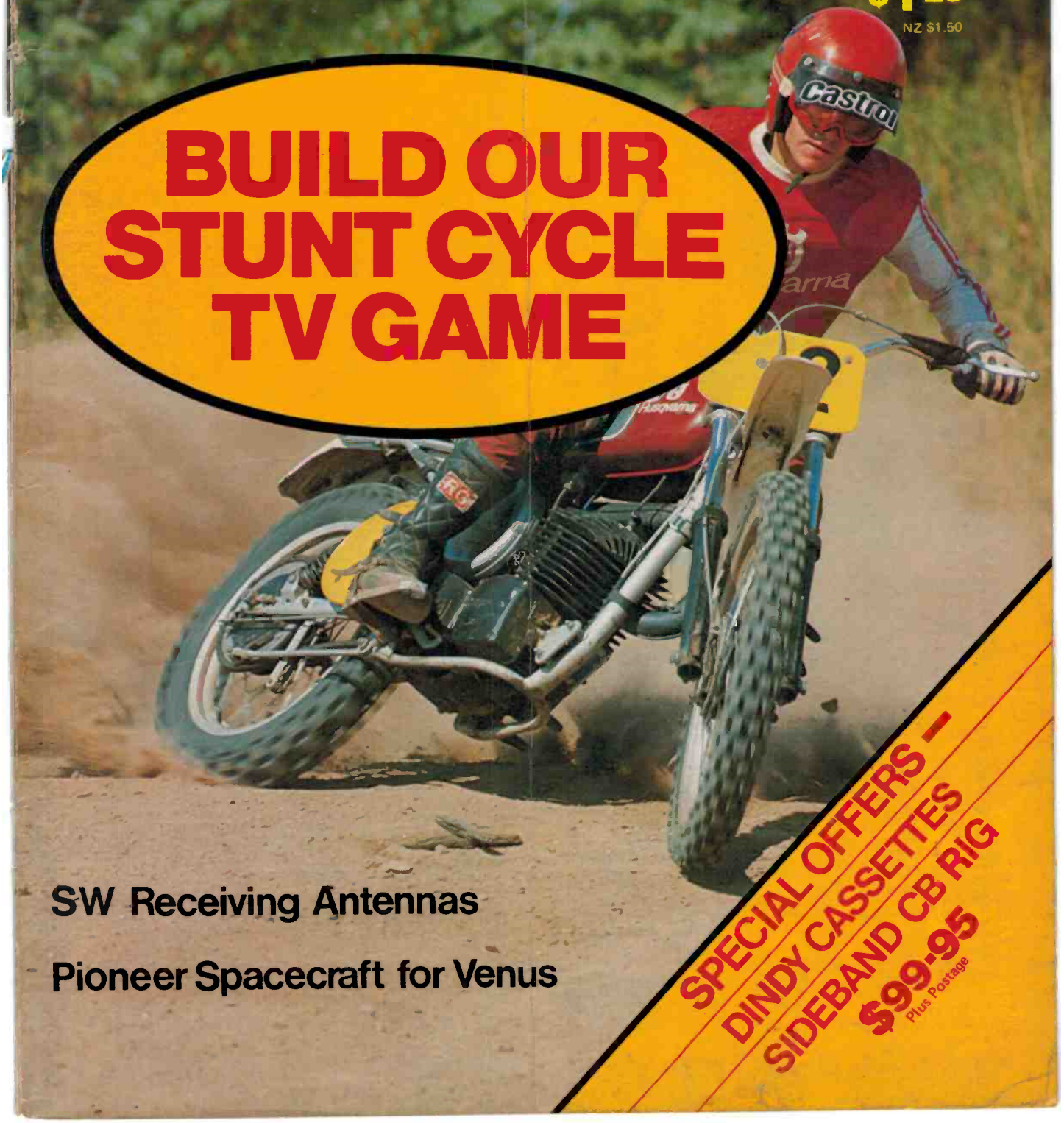

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STUNT CYCLE TV GAME

* simple to build
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* pro–am

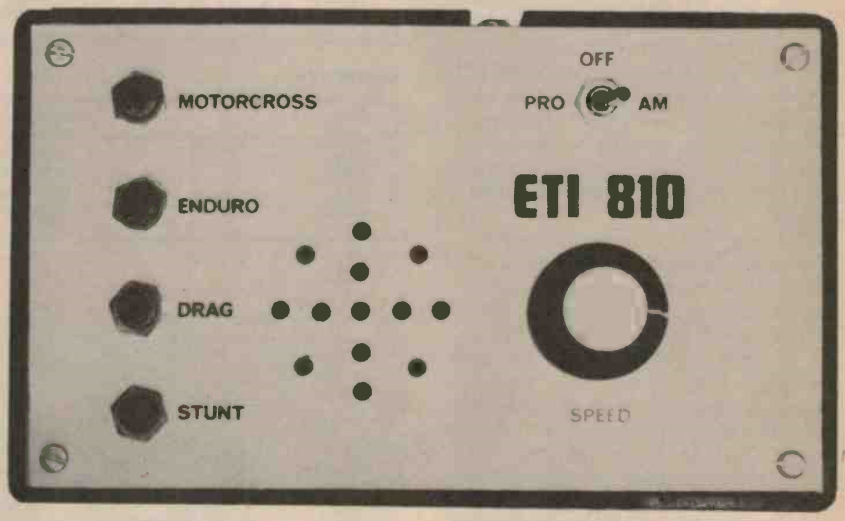
Fall off without injury on our latest TV game.

THE ELECTRONIC TV GAME was first conceived in 1966, when Sanders Corporation acquired the first patents on the logic which is used to digitally generate bouncing bats, balls and similar artifacts on a TV screen. However, the first actual TV game appeared in 1972, when Magnavox introduced the Odyssey, which was the precursor of modern TV games. The early games did not display boundaries or score, and were based on lots of TTL IC's.

The next generation of games used some LSI logic, but were still quite complex. They were a great improvement over earlier games in that they displayed boundaries and kept score, thus settling a lot of family disputes! The third generation came about when General Instruments Microelectronics designed the AY-3-8500 games chip, which put virtually the whole logic on one IC. This IC, which was used in the ETI 804 Selectagame, was fortunately produced in versions to suit both American and European/Australian standards, and has led to the development of more sophisticated 'games-on-a-chip', one of which is used in this project.

Finally, the latest generation of TV games are programmable types, few examples of which are available in Australia, and which are, at present, a little outside the scope of a magazine project.

The ETI 810 Stunt Cycle TV Game is rather different from the conventional bat-and-ball type games. Instead, it offers four different types of games involving motorcycles - Drag Race, Motorcross, Stunt Cycle and Enduro.



At the start of each game, the motorbike and rider are stationary at the upper left-hand side of the TV screen. As the player turns the throttle controller, the bike moves across the screen on track 1, with appropriate sound effects.

At the end of track 1, the bike and rider reappear on track 2, and likewise at the end of track 2, the bike appears on track 3. On reaching the end of track 3, the bike will reappear at the beginning of track 1, and the game will reset. There will be no movement until the throttle is reset to a slow speed and then increased.

The Drag Race game involves a straightforward 'race against the clock' from one end of the track to the other. In Drag Race, the bike has 'gears' which must be shifted, by throttling back and then accelerating, to achieve top speed. In the PRO mode, if the bike is accelerated too fast, it will flip over, crash and screech to a halt.

Motorcross involves a race against the clock, this time doing 'wheelies' across obstacles. Hitting an obstacle causes a crash, and in this game, the PRO/AM switch varies the number of obstacles.

If Evel Knievel is your hero, Stunt Cycle will appeal to you - here the idea is to jump a ramp and buses located on track 3, by judging the correct throttle setting. If a jump is successful, the number of buses is increased by one - the initial number is eight. The game is

over when the maximum number of crashes has occurred, which is 3 or 7 depending on the position of the PRO/AM switch. The displayed score indicates the number of crashes and the number of buses between the ramps.

Finally, Enduro combines the Motorcross and Stunt Cycle games, with obstacles on tracks 1 and 2 and buses and ramps on track 3. The object of Enduro is to do wheelies over the obstacles and then adjust the throttle to jump the buses. The PRO/AM switch alters the number of obstacles and the number of crashes permitted - this game is quite difficult in the PRO mode.

All the games are accompanied by appropriate sound effects, with engine noises and skidding sounds.

Construction

Start with the assembly of the pc board. With the aid of the component overlay initially fit the resistors in their correct position. Push them flush with the pc board, turn the board over and solder them onto the copper tracks. Cut the leads off close to the solder joint. Now add the capacitors noting that both C3 and C6 are polarized and must be inserted the correct way round. The two transistors can now be soldered in noting that they are different types and also that they must be correctly positioned.

With the IC's it is recommended, although not essential, that sockets be used, for at least the main one. If a Molex type connector is used for IC2 it should be cut into two strips of 14, then inserted in the board and soldered. Then by carefully bending the connector strip over at rightangles and back again, it will break off. Before the IC's can be fitted into either the socket or the pc board, the pins normally need bending in slightly. This can be done by holding the IC by both ends and pressing the pins on the table with a slight rolling action to bend all pins together. Do this with both sides until the pins are at right angles to the body of the IC. This should allow the IC to fit easily.

The modulator can be now fitted and soldered into place. Finally the crystal can be fitted to the pc board.

The front panel should now be assembled with the speaker being glued on with 5 min epoxy cement, in the position shown in the photograph. Solder lengths of tinned copper wire (about 30mm) to each of the terminals of the push buttons, switch and potentiometer. Solder about 50 mm of plastic covered wire to each of the speaker connections.

Double check that all components are on the pc board and are correctly orientated. Now slide the pc board over the wires from the switches until the board is about 30 mm from the front panel. Pull each of the lengths of wire with a pair of pliers to ensure it is straight and not able to shortout on an adjacent wire, solder them all onto the pc board and cut the tails off. The wires from the speaker can now be fitted through the holes provided and soldered.

The plastic box needs a slot cut in the top edge to allow the output socket of the modulator to fit and this should be cut now. Also a hole is needed for the external power socket if required.

The wiring from the board to the external power socket and to the battery pack can now be done. This now completes the unit and as no adjustments are needed it should work on switch on.

Component markings

Resistors

CODE	COLOUR BANDS				VALUE (ohms)
47R	YELLOW	VIOLET	BLACK	GOLD	47
330R	ORANGE	ORANGE	BROWN	GOLD	330
1k	BROWN	BLACK	RED	GOLD	1000
1k2	BROWN	RED	RED	GOLD	1200
2k7	RED	VIOLET	RED	GOLD	2700
10k	BROWN	BLACK	ORANGE	GOLD	10000
12k	BROWN	RED	ORANGE	GOLD	12000
15k	BROWN	GREEN	ORANGE	GOLD	15000
22k	RED	RED	ORANGE	GOLD	22000
100k	BROWN	BLACK	YELLOW	GOLD	100000
4M7	YELLOW	VIOLET	GREEN	GOLD	4700000

Capacitors

CODE	COMMON MARKINGS	VALUE
33p	33 or 33p	33pF
100p	100, 100p or n10	100pF
10n	0.01k or 103k	0.01μF
100n	0.1k or 104k	0.1μF

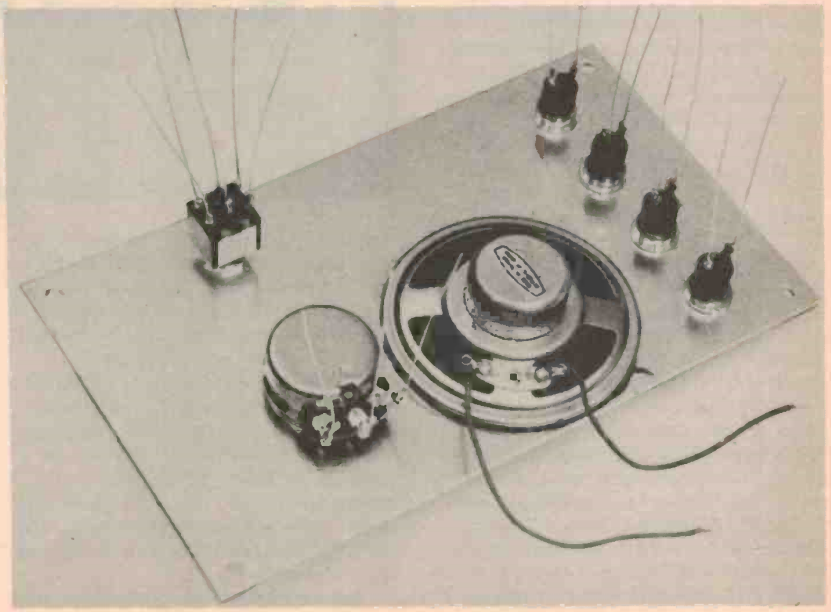


Photo showing the position of the speaker and how the tinned copper wire links are fitted.

Stunt Cycle TV Game

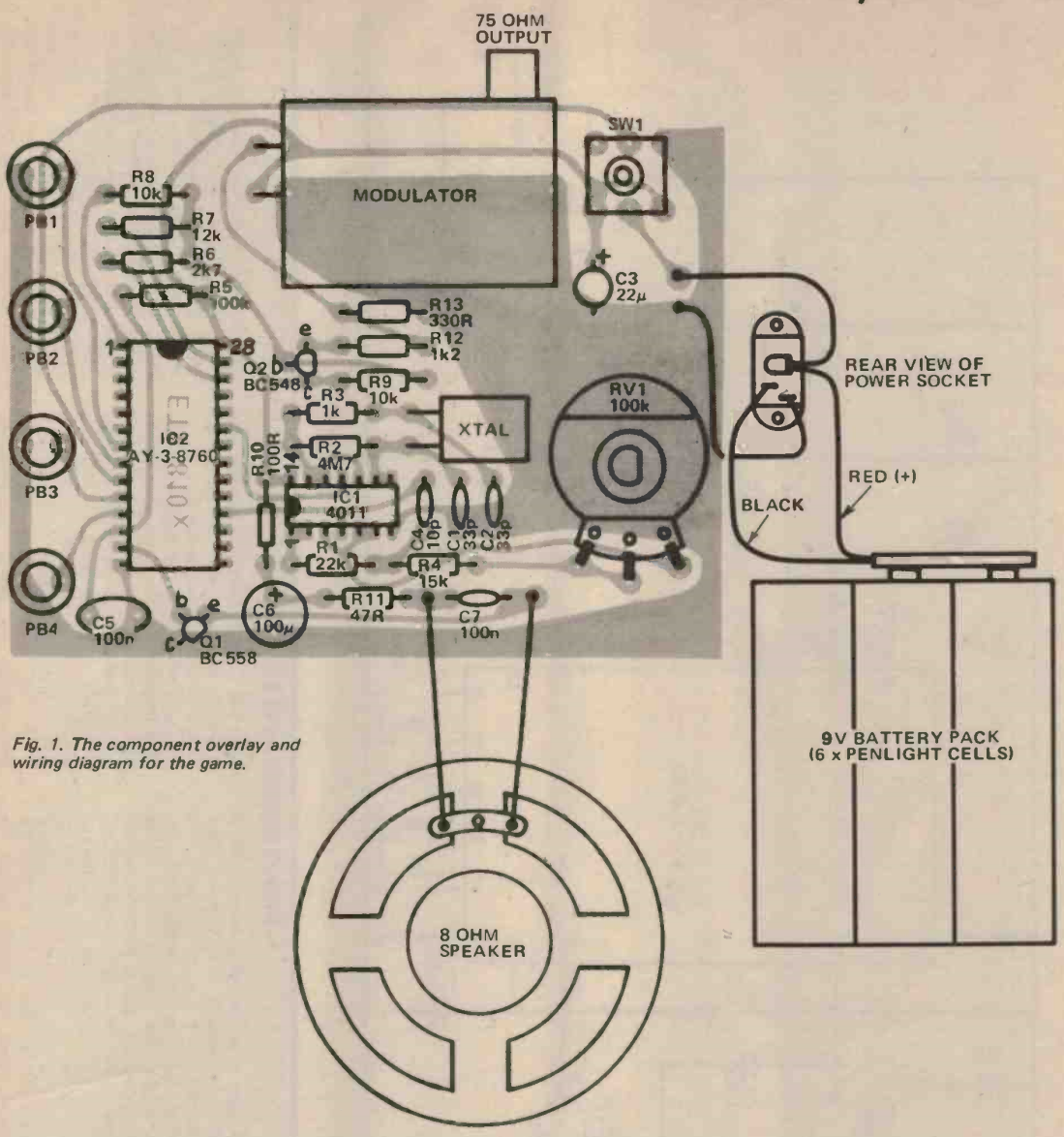


Fig. 1. The component overlay and wiring diagram for the game.

PARTS LIST – ETI 810

Resistors all ½W 5%
- R1 . . . . . 22k
- R2 . . . . . 4M7
- R3 . . . . . 1k
- R4 . . . . . 15k
- R5 . . . . . 100k
- R6 . . . . . 2k7
- R7 . . . . . 12k
- R8, 9 . . . . . 10k
- R10. . . . . 100R
- R11. . . . . 47R
- R12. . . . . 1k2
- R13. . . . . 330R

Potentiometers
- RV1 . . . . . 100k lin rotary

Capacitors
- C1, 2 . . . . . 33p ceramic
- C3. . . . . 22µ 16V electro
- C4. . . . . 100p ceramic
- C5. . . . . 100n polyester
- C6. . . . . 100µ 16V electro
- C7. . . . . 10n polyester

Semiconductors
- IC1 . . . . . 4011 (CMOS)
- IC2 . . . . . AY–3–8760
- Q1 . . . . . BC558
- Q2 . . . . . BC548

Miscellaneous
- PC board ETI 810
- TV Modulator (UM1082)
- 3.576545 MHz crystal
- 5 pushbuttons
- 1 DPDT centre off toggle
- 8 ohm speaker (55mm dia.)
- 28 pin IC socket
- plastic box 158 x 96 x 50mm
- six way AA size battery holder
- battery clip
- length of 75 ohm coax
- one 75 ohm plug
- one RCA plug
- external battery socket

KITS FOR THIS PROJECT WILL BE AVAILABLE THROUGH DICK SMITH ELECTRONICS.

STUNT CYCLE TV GAME

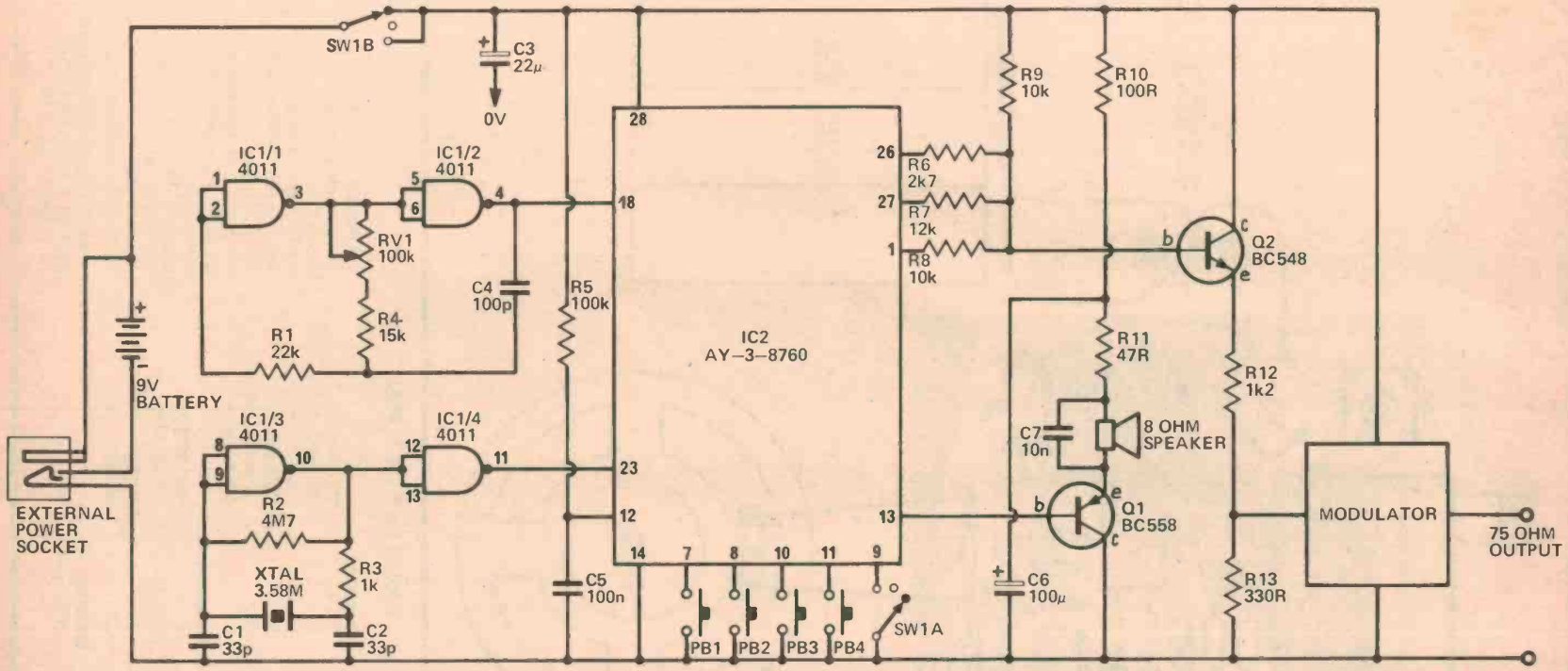


Fig. 2. The circuit diagram of the stunt cycle TV game.

HOW IT WORKS – ETI 810

As this project is going to be built by many beginners we will try to give as complete an explanation of the operation as possible. However, as most of this is done by the main IC and as not much can be said about the internal workings of this IC the explanation will be mainly about the external components.

The IC needs a high frequency clock (3.579545 MHz), to derive all its internal waveforms and the synchronising pulses needed. To eliminate any adjustments we used a crystal oscillator formed by IC1/3. The output of the crystal oscillator is buffered by IC1/4 before driving the main IC.

This gives a square wave output and is used by the main IC to control the speed of the bike.

With this type of oscillator the current in RV1/R4 tries to charge C4 so that the voltage across RV1/R4 will try to fall to 0V. When the output of IC1/2 goes to +9V the junction of R1, R4 and C3 is lifted to +13.5V. As the output of IC1/1 is now 0V, C4 will be charged towards 0V by the current in RV1/R4. However, when the voltage reaches the threshold (4.5V) of IC1/1 the output of IC1/1 goes high, IC1/2 low which pushes the voltage at the junction to -4.5V (i.e., as the voltage at one end

main IC. The resistor R5 charges this capacitor in about 10mS and after this period the network has no effect.

Game selection is one simply by four push buttons from the appropriate pins to 0V. Internal 100 k pullup resistors are provided and a latch inside the IC remembers which game has been selected. The selection of PRO or AM modes has to be done with a switch as it has no memory.

We use four outputs in this circuit, these being the sound, synchronising pulses, white information and black information. All these outputs are "open drain" field effect transistors which means that the output is either open cir-

As the horizontal lines are not really horizontal but have a slight slope (1/312.5 of the screen height) the second "frame", which starts halfway through a line, fits between the first set of lines giving a total of 625 lines. A pulse is needed every 20 ms (0.020 sec) to give this synchronisation. These pulses are negative ones and the line sync is 4µs long while the frame sync is 250µs long. The IC gives the combined sync on pin 26. To simplify the design the IC actually gives only 312 lines per frame but the TV set accepts this with no problem.

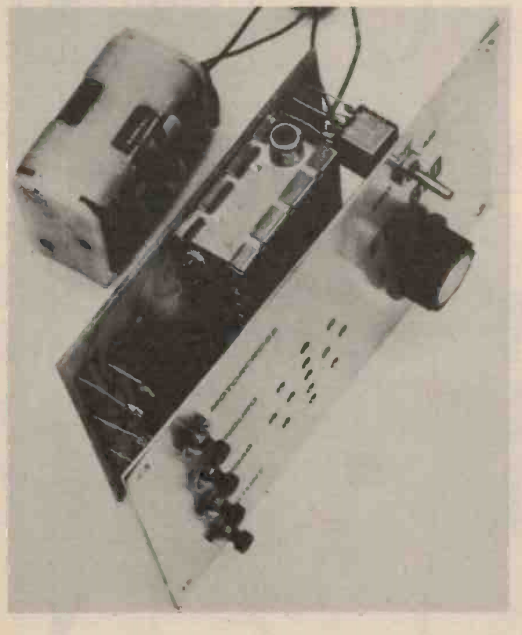
The white information, which means the score, bike and obstacles, consists of

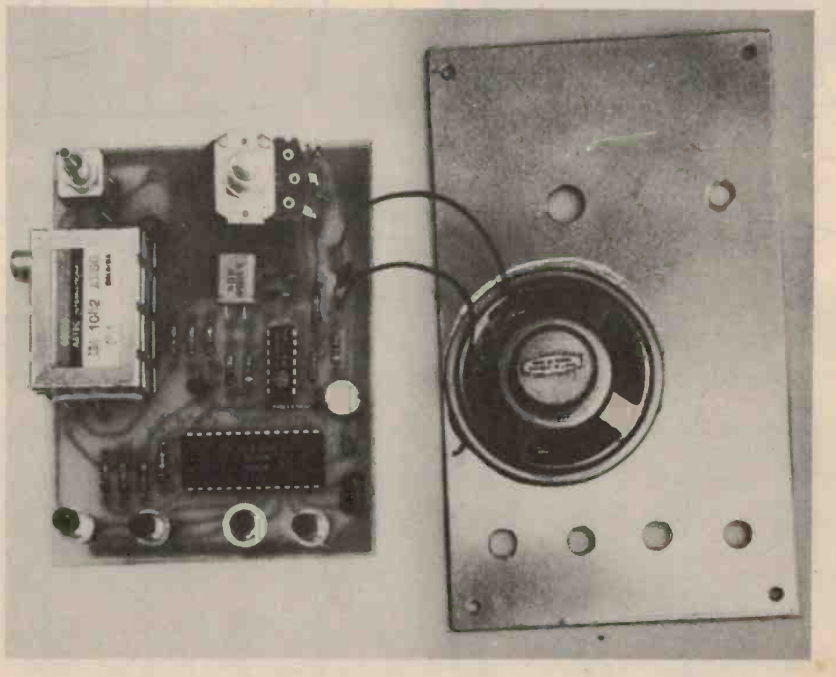
This IC is a digital NAND gate connected as an inverter. If the input voltage (on pin 8, 9), is at 0V then the output (pin 10) will be at +9V. Conversely if the input is at +9V the output will be at 0V – hence the name, inverter. As the input voltage is raised from 0V to +9V the output will initially remain at +9V until the input reaches the "threshold" point, which is about midvoltage, when the output will switch to 0V. The converse applies when the input is dropped from +9V to 0V. There are four sections in this IC all of which are the same with only the pin numbering differing.

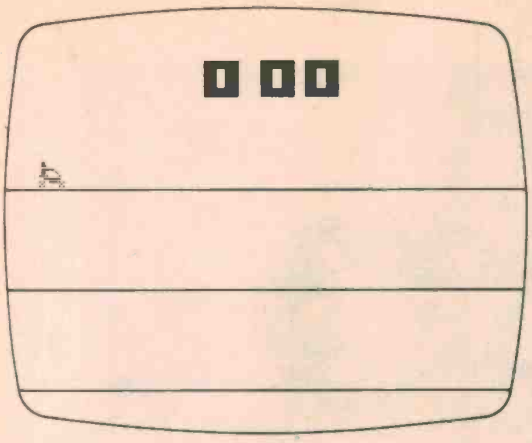
An RC oscillator is formed out of the two remaining sections of IC1 and has a frequency range of 50kHz to 250kHz. of the capacitor changes suddenly by 9V the voltage at the other end must change by a similar amount). The voltage at the junction ow tries to charge to +9V (the output of IC1/1) but when the voltage reaches +4.5V the output of IC1/1 again reverses state as does IC1/2, and the process repeats itself. As the time taken to charge the capacitor depends on the resistance in series, changing RV1 will vary the frequency. Due to IC1 not liking voltages on its input which exceed the supply rails R1 is used to give protection. The IC has protection diodes to each supply rail and hence R1 does carry some current while the junction of R1, R4 and C4 is beyond the supply rails.

On initial switch on C5 holds pin 12 of IC2 low for a short time, resetting the cuit or connected to 0V. With the sound output, we use Q1 to buffer the output (it cannot handle more than about 2mA) and drive the speaker. Resistor R11 limits the current through the speaker and hence the volume, while resistor R10 and capacitor C6 prevent the high current pulses needed for the speaker affecting the rest of the circuit.

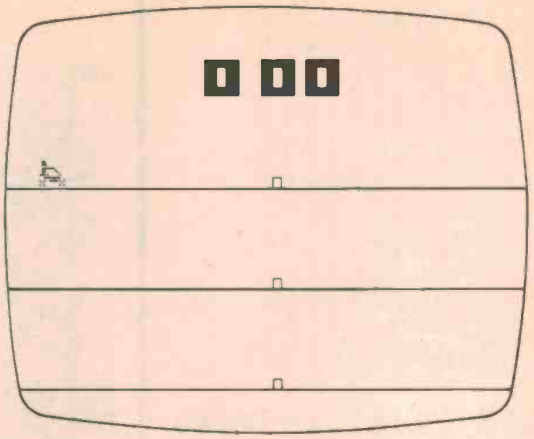
A TV picture is made up by a single beam of electrons hitting a phosphorescent screen which is scanned in horizontal lines with each successive line just under the previous one. By varying the intensity of the beam the brightness of the screen can be varied. With the Australian system each horizontal line takes 64μs (i.e., 0.000064 s) and every 312½ lines the beam reverts back to the top of the screen. positive pulses and is available on pin 27 of the IC. The black information which is the roadway and the ramps for the jump are negative pulses (though not as negative as the sync pulses) and come out on pin 1 of the IC. These outputs are mixed by R6-R9, then buffered by Q2. The voltage at the emitter of Q2 is 0.6V lower than the base, has the same waveshape but has much lower impedance. The output of Q2 is reduced by R12/13 before being fed into the modulator. The output of the modulator is high frequency with the information superimposed on it, and is tuned in by the TV set as a normal program.



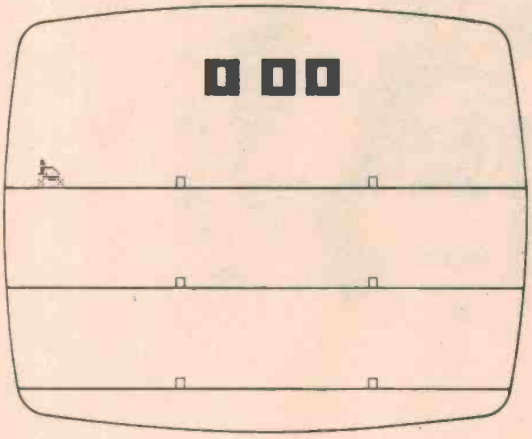




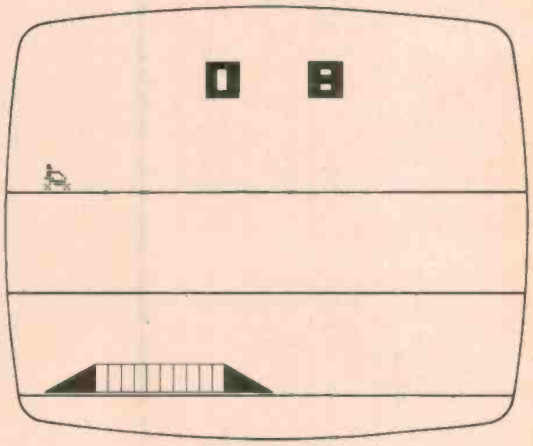
DRAG RACE



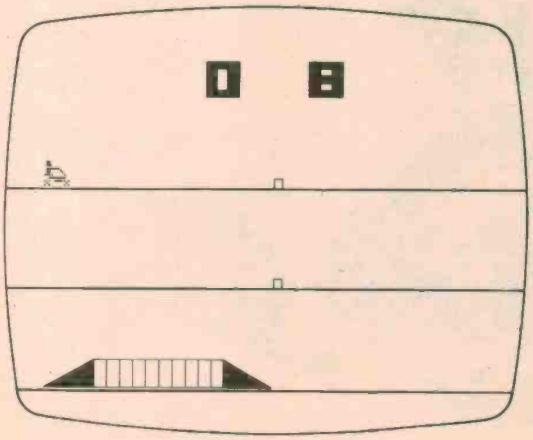
MOTORCROSS (EASY)



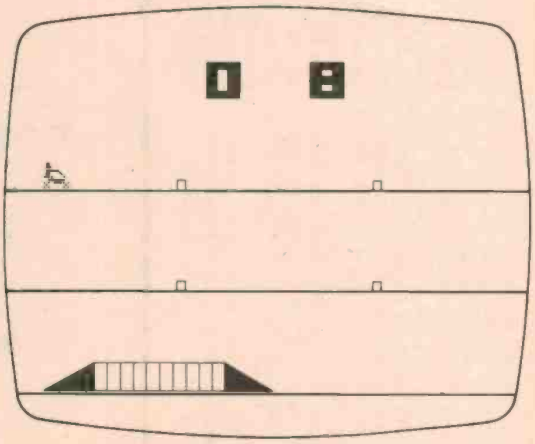
MOTORCROSS (HARD)



STUNT CYCLE



ENDURO (EASY)



ENDURO (HARD)

Drag Race

The object of this game is to reach the end of track 3 in the shortest time. The three-digit score is automatically reset as the rider first begins to move on track 1 and the score is incremented until the game is over. The score appears centered on the screen above track 1, and the score remains until the start of the next game.

Drag Race requires a speed shifting to achieve the lowest time scores. As the throttle speed is increased and the rider begins to move, the bike object is in speed one and moves at a set rate across the screen. The only way to accelerate the bike's motion is to return the throttle to a 'slow' position and then turn to a 'fast' position. This shifting prodedure will move the bike into speed 2 and the object will go across the screen at a faster rate. Another 'shift' will allow speed 3.

A PRO/AM option switch is provided to select a difficulty factor. In the hard mode, a crash occurs if the player trys to increase the throttle speed too rapidly. A crash will flip the bike and rider upside down and the sound will be a high-pitch screech. At the end of the crash, the bike and rider are reinitialized on track 1 and the score reset. In the easy mode, no crash is allowed.

Enduro

This game is similar to Stunt Cycle with the addition of obstacles on track 1 and track 2. The object of Enduro is to do a wheelie over each obstacle and then adjust the throttle for the correct speed to jump the buses on track 3. The PRO/AM option switch selects 2 obstacles per track and allows 3 errors per game in the hard mode, and 1 obstacle per track and 7 errors per game in the easy mode. Errors are caused by accelerating too rapidly, not in wheelie position over the obstacles, insufficient speed to clear the buses, or landing too far past the back ramp after the jump. The score records the number of errors and the number of buses displayed the same as in the game of Stunt Cycle.

Motorcross

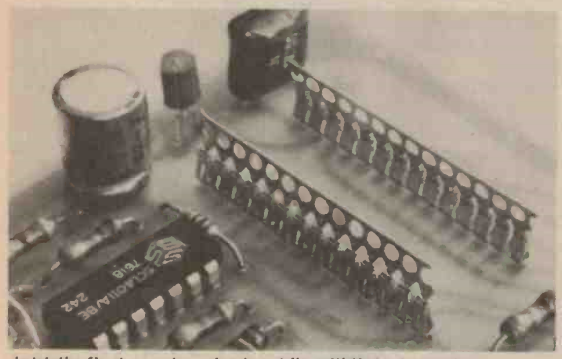
As the throttle speed is increased, the bike and rider move across track 1 at a rate determined by the throttle controller setting. Motorcross has no speed shifting. Located on each of the three tracks are obstacles. The easy/hard option switch selects the number of obstacles per track. The easy mode has one obstacle per track and the hard mode has two obstacles per track.

The object of this game is to traverse the three tracks in the shortest time, doing a wheelie over each obstacle. The score counters record the run time in the same manner as the Drag game.

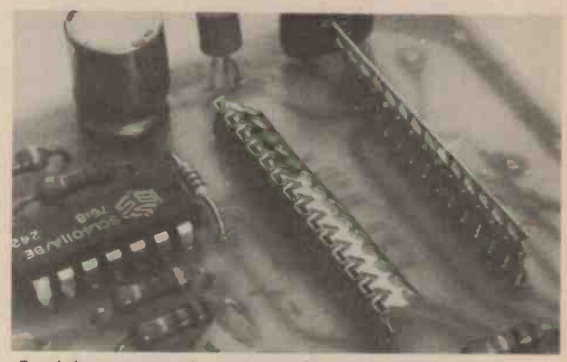
In Motorcross, the crash is not caused by accelerating too rapidly. The crash is caused by not doing a wheelie over an obstacle. In the wheelie position, the bike will have the front wheel lifted off the track. A crash into an obstacle will flip the bike upside down and produce the screech sound. The score is reset at the end of the crash.

Stunt Cycle

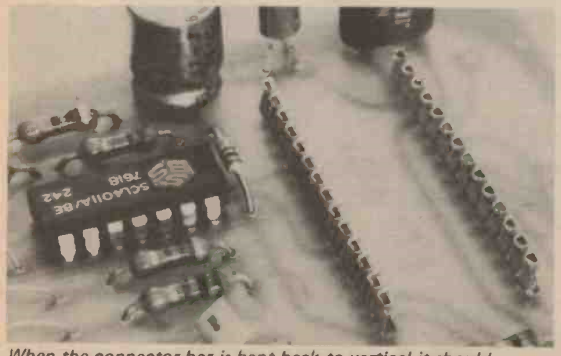
The object of this game is to control the throttle speed to properly jump the ramp and buses located on track 3. The game begins with 8 buses and with each successful jump over the ramp and buses, an additional bus appears. The game is over when the maximum number of errors has been reached, which is 3 or 7 errors depending on the position of the PRO/AM switch. The game is then started by reselecting the Stunt Cycle game input. Errors are caused by accelerating too rapidly, insufficient speed to clear the buses, or landing too far past the back ramp after the jump. The bike and rider flip upside down and a screeching sound indicates an error. The score records the number of errors in the first digit and the number of displayed buses in the next digits.



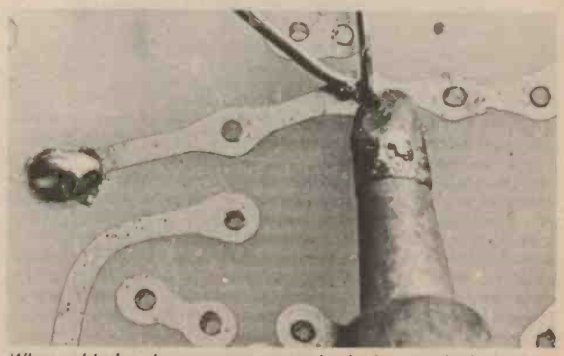
Initially fit the molex pins in while still linked together by the connector.



Bend the connector bar over evenly being careful not to distort the pins.



When the connector bar is bent back to vertical it should break off leaving the pins separated.



When soldering the components apply the iron to the junction of the lead and the track, then feed the solder into the junction. Do not carry the solder to the joint on the tip of the iron!